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The use of the integrated product team in the Naval Tomahawk Cruise Missile program at the Defense Contracting Management Agency Raytheon

Kao, David H.

Monterey, California. Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

THE USE OF THE INTEGRATED PRODUCT TEAM IN THE NAVAL TOMAHAWK CRUISE MISSILE PROGRAM AT THE DEFENSE CONTRACTING MANAGEMENT AGENCY RAYTHEON

by

David H. Kao

December 2000

Principal Advisor: James M. Barnard
Associate Advisor: David V. Lamm

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13. ABSTRACT ***(maximum 200 words)***

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Overall, team members who have participated in or managed an IPT agree that IPT has added value to the acquisition process by bringing functional disciplines from Government and industry together to exchange ideas and build a successful Tomahawk Program. Only a few team members reported that the IPT process led to problems in the decision-making process, alignment of team objectives, and contractor and Government working relationships.

Although both contractor and Government team members have some misunderstandings and preconceived notions about each other, both organizations realize that an effective Government and contractor interface provided by the IPT process is crucial to the success of the Tomahawk Program.

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THE USE OF THE INTEGRATED PRODUCT TEAM IN THE NAVAL TOMAHAWK CRUISE MISSILE PROGRAM AT THE DEFENSE CONTRACTING MANAGEMENT AGENCY RAYTHEON

David H. Kao
Lieutenant Commander, United States Navy
B.S., University of Alabama at Birmingham, 1989

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December 2000

Author: [redacted]
David H. Kao

Approved by: [redacted]
James M. Barnard, Principal Advisor

[redacted]
David V. Lamm, Associate Advisor

[redacted]
Reuben T. Harris, Chairman
Department of Systems Management

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ABSTRACT

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I. INTRODUCTION

A. BACKGROUND

In May 1995, then Secretary of Defense William Perry issued a memorandum to all Military Service Secretaries requiring the use of Integrated Product Teams (IPTs) throughout the acquisition process to the maximum extent practicable. [Ref. 7] This memorandum described the use of IPTs as a management technique that simultaneously integrates all essential acquisition activities through the use of multidisciplinary teams to optimize the design, manufacturing, and program support processes. The memo also noted that many commercial companies and selected military programs had successfully implemented the IPT process. Secretary Perry's memo prompted the Department of the Navy (DoN) to form IPTs for several major weapons programs, including the Tomahawk Cruise Missile Program.

The IPT concept for oversight and review was developed to streamline what was viewed to be an antiquated and inefficient acquisition process. Before the IPT process was implemented throughout the Department of Defense (DoD), major program offices frequently produced a product that, when reviewed at the Office of the Secretary of Defense (OSD) level, was modified substantially or even rejected. The IPT process was adopted in order to address these concerns by facilitating decision-making and by making recommendations based on timely input from the entire team. In the IPT process, individual team members are usually comprised of designers, engineers, contract specialists, financial

specialists, customers, program integrators, and program managers. The IPT approach takes advantage of all of these members' expertise and strives to produce an affordable and acceptable product the first time.

The formation of IPTs within different major weapons programs, like the Tomahawk Cruise Missile Program, is heavily dependent upon the manning level within a program and its budgetary constraints. Because there is no one perfect IPT model that will fit all programs, individual program offices need to tailor their IPTs within their organization to achieve the maximum benefits of the IPT process. However, all IPTs should function in a spirit of teamwork with members empowered and authorized to make commitments for the organization or the functional area they represent.

B. OBJECTIVES

This thesis will provide the reader with a basic understanding of how the Integrated Product Team (IPT) concept is being utilized in the Tomahawk Cruise Missile Program within the Defense Contracting Management Agency (DCMA) Raytheon. The study will focus on the following four areas of the Program-Level IPTs: 1) IPT dynamics; 2) IPT performance; 3) IPT training; and 4) the working relationship between contractor and Government personnel on IPTs. The analysis section of this study will examine each of the stated areas of the IPT process, and the role of the Administrative Contracting Officer (ACO) in the IPTs.

C. RESEARCH QUESTIONS

1. Primary Research Question

How are IPTs being utilized in the Naval Tomahawk Cruise Missile Program within the Defense Contracting Management Agency Raytheon (DCMA Raytheon)?

2. Subsidiary Research Questions

- Is the utilization of IPTs achieving the Tomahawk Cruise Missile Program's objective(s)?
- What are the challenges encountered by the Tomahawk Cruise Missile Program's IPTs?
- What is the Administrative Contracting Officer's (ACO) role with regard to the IPTs?
- What is the working relationship between the contractor and Government personnel on the IPTs?

D. SCOPE

This thesis analyzes the utilization of the Tomahawk Cruise Missile Program IPTs within DCMA Raytheon, Tucson. It analyzes the IPTs' dynamics, the IPTs' performance, the IPTs' training, and the attitudes that Raytheon and Government personnel have toward each other on IPTs. This thesis also makes recommendations on research findings to DCMA Raytheon for further improvement of their IPT processes.

This thesis does not examine, in any detail, Overarching Integrated Product Teams (OIPTs) or Working Integrated Product Teams (WIPTs), which support the Office of the Secretary of Defense (OSD), Department of the Navy, and the Program Executive Office (PEO) level oversight roles respectively. However, a short overview of these IPTs is included in Chapter II to provide the reader with a basic background and understanding of the IPT concept within

DoD. This thesis is focused on the Program-Level Integrated Product Teams within DCMA Raytheon.

E. METHODOLOGY

The methodology used in this thesis consisted of the following steps.

- Conducted a literature review of books, professional journals, magazines articles, Internet based materials, and other library information resources
- Examined active Tomahawk Cruise Missile Program IPTs in progress by site visitation and conducted a survey and face-to-face interviews with key contractor and Government personnel involved in the IPT process

F. ORGANIZATION OF THE THESIS

This thesis is divided into five chapters, which will lead the reader through an analysis of the IPT process within the Tomahawk Cruise Missile Program at DCMA Raytheon.

Chapter I introduced the topic and provided background information on the IPT concept. Chapter II presents the development of the IPTs and literature review of the IPT philosophy and concept within the DoD. This chapter defines the types of IPTs within DoD, identifies some of the characteristics of effective teams, the challenges of implementing IPTs, empowerment issues, risks, and team member responsibilities.

Chapter III provides an overview of the Tomahawk Cruise Missile Program-Level IPT structure within DCMA Raytheon, outlines the general research strategy, and presents the researcher's findings. Chapter IV analyzes the researcher's findings collected through interviews and survey with contractor

of the findings and makes recommendations for further improvement of the IPT process at DCMA Raytheon and topics for future research.

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II. LITERATURE REVIEW

A. INTRODUCTION

This chapter first addresses the development of IPTs and presents the types of IPTs used within the DoD. The chapter then provides basic concepts and principles within a Program-Level Integrated Product Team (PIPT), identifying some of the characteristics of effective teams, the challenges and risks of implementing IPTs, and the training and empowerment issues associated with IPTs. Gaining this understanding of the background, concepts, and principles of IPTs is important to any team-based organization.

B. DEVELOPMENT OF IPTS

As Major Defense Acquisition Programs' review and decision processes became more lengthy and complex, the Department of Defense (DoD) developed a new acquisition management process to try to deal with this problem. This process, which embraces a new relationship between the functional and program management organizations, is known as Integrated Product and Process Development (IPPD). IPPD reflects a greater degree of coordination among functional disciplines and utilizes the formation of new teams known as Integrated Product Teams (IPTs) to achieve a more streamlined acquisition process.

A proposal to use IPTs throughout DoD originated with the OSD-Acquisition Reform Process Action Team (PAT), a team chartered by the Secretary of Defense to develop a plan to reengineer the oversight and review

process for Major Defense Acquisition Programs (MDAPs). [Ref. 1;p.11] Drawing on the growing popularity of the teaming concept in commercial industry, the PAT recommended the use of IPTs throughout the DoD to accelerate the milestone review and approval process and to reduce delays attributable to OSD staff review.

Since July 1995, OSD has provided additional insight and guidance through the publications of the Rules of the Road: A Guide for Leading Successful Integrated Product Teams [Ref. 10] and the DoD Integrated Product and Process Development Handbook. [Ref. 2] In accordance with these DoD published guidelines, the IPT is defined as:

> A multidisciplinary group of people who are collectively responsible for delivering a defined product or process. The IPT is composed of people who plan, execute, and implement life-cycle decisions for the systems being acquired. It includes empowered representatives (stakeholders) from all of the functional areas involved with the product – all who have a stake in the success of the program, such as design, manufacturing, test and evaluation, logistics personnel, and especially, the end-user. [Ref. 2;p.6]

In May 1995, the Secretary of Defense issued a memorandum requiring the use of IPTs throughout DoD. Dr. Paul Kaminski, the Under Secretary of Defense (Acquisition & Technology) (USD [A&T]), in July 1995, hosted a daylong meeting with more than 400 senior members of DoD's acquisition community. The meeting had two objectives: [Ref. 5;p. 25]

- To make sure that key DoD acquisition leaders had a common understanding of what IPTs are, how they operate, and how the IPT process differs from the traditional acquisition process that DoD has used to oversee and review major acquisition programs.
- To make sure that there was a genuine commitment by all functional disciplines to use IPTs.

Unlike traditional, hierarchical management structures that separate functional responsibilities, the IPTs help the DoD acquisition process achieve the following four specific objectives:

- To capitalize on the strength of all participants to develop programs with the highest chance of success by fostering early participation from the OSD to the contractor level.
- To move away from an adversary relationship between the program office and OSD staff toward a cooperative partnership. This is to encourage the program office and OSD staff to work together to solve program issues at the earliest time.
- To focus on working as cross-functional teams to optimize overall system performance.
- To tailor each acquisition process to the individual acquisition program. [Ref. 5:p. 25]

Within DoD's major acquisition programs, specifically Acquisition Categories 1D & 1AM, there are generally three levels of IPTs. Table 1 displays the organization and responsibilities of the three levels of IPTs.

Table 1. Three Types of Integrated Product Team (IPT).

Types	Organization	Responsibilities
Overarching IPT (OIPT)	OSD staff principals, USD(A&T) staff, Program Executive Office, Component staff, Program Manager	Program success, Functional area leadership, Independent assessment, and Issue resolution.
Working-Level IPT (WIPT)	OSD staff, Program manager, Component staff	Functional Knowledge & Experience, Empowered contribution, Recommendation for program success, and Communicate status & unresolved issues.
Program-Level IPT (PIPT)	Program teams & System contractor	Manage complete scope of program, resources, & risk, Integrate Government & contractor efforts for program success, and Report program status & issues.

From: [Ref. 10:p.3]

C. ORGANIZING FOR IPTS

1. Tenets

Integrated Product and Process Development provides a formal structure based on a set of ten tenets that have been used in diverse segments of the commercial industry. The application of these tenets helps to ensure that major acquisition programs achieve the IPPD goals. As shown below, the IPT process is one of the key enabling tenets of IPPD. Explanation of these ten tenets, listed below, is cited in the Appendix. [Ref. 7]

- Customer focus
- Concurrent development of product and process
- Early and continuous life cycle planning
- Maximize flexibility for optimization and use of contractor-unique approaches
- Encourage innovative design and improved process capability
- Event-driven scheduling
- Multidisciplinary teamwork through IPTs
- Empowerment
- Seamless management tools
- Proactive identification and management of risk

2. IPTs in the Execution Process

The execution of a Major Defense Acquisition Program occurs at the PIPT level. A PIPT typically consists of end-user representatives, program management personnel, prime contractors, and subcontractors. A description of these key "stakeholders" is provided below.

The end-user, that person who will actually benefit from the acquired product or service, contributes to a successful PIPT program in the initial stage of

mission needs. The end-user also continually provides feedback on the design process along with valuable input in cost and performance tradeoffs throughout the life cycle of a program.

Program management personnel, including but not limited to direct managers, engineers, contracting, and legal personnel continuously provide technical and management direction to the program effort from its inception through its completion.

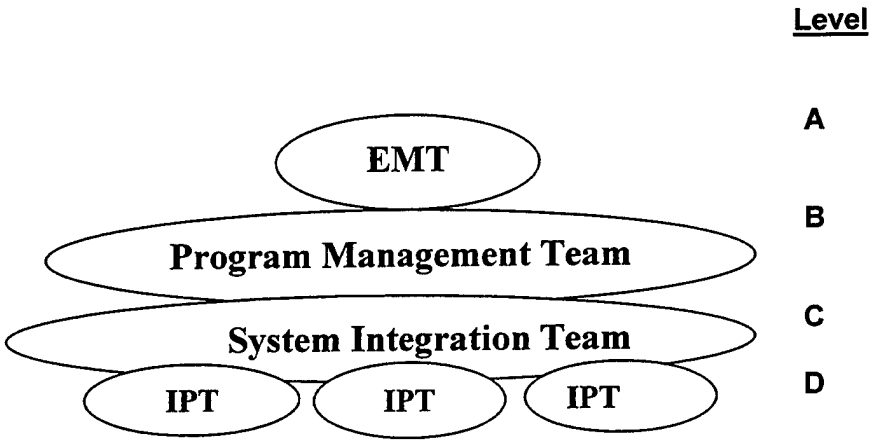
Representatives from the prime contractor are responsible for the ultimate designing, developing, and delivering of the product or service to the end-user. Membership on the PIPT allows the contractor to address specific issues, focusing mainly on resolving technical problems, providing and receiving guidance and counsel on all technical issues, and assessing the possibility of applying new technologies to the program. The contractor accomplishes management of these areas or concerns through the use of their own internal IPTs.

Involvement of subcontractors, the recipients of work delegated down from the prime contractor, on the PIPT can prove to be highly innovative and produce high-quality, technologically advanced components. Membership on the PIPT allows subcontractors to stay current on important issues, such as contract management and risk management, which require a high level of communication and control between the subcontractors and the prime contractor.

3. Program-Level IPT (PIPT) Organization

Figure 1 presents a typical PIPT structure. The structure illustrates four levels, the highest being the Executive Management Team (EMT). Normally, the Executive Manager is the Program Manager (PM). However, under various teaming arrangements made between the Government and the contractor, an executive management team (EMT) may co-lead. The EM (or EMT) establishes a PIPT for specific areas or issues.

Figure 1. Program-Level Integrated Product Team (PIPT).



After: [Ref. 10:p.5]

Multiple team levels of IPTs may be needed due to program size or product complexity. The risk associated with a product, such as high cost, technological complexity, or compressed delivery schedule, will determine how many levels of IPTs are required.

The lower-level teams (Levels C and D) manage elements of the program's resources and risk, integrate Government and contractor efforts, and report program status and issues. These teams are necessary to execute and track program plans, usually in agreement with the program's Work Breakdown

Structure (WBS). The lower-level teams may consist of representatives from DoD, the end-user, and the contractor. IPTs may be created in a horizontal or vertical relationship with other IPTs. Normally, the lower-level IPT leaders are members of the intermediate Program-Level IPT that coordinates the work effort.

As Figure 1 shows, a normal PIPT consists of the following team levels: a program management team, a system integration team, and individual IPTs. This structure allows for the creation of an integrated management plan using resources as part of a disciplined approach. The Executive Manager can then outline responsibilities of constituent teams. A description of each team is discussed below.

At the top of the structure, the Executive Management Team (EMT) provides overall strategic guidelines and manages the capabilities and performance of the IPTs. The Program Management Team (PMT) is responsible for coordinating the management of a number of IPTs that are interdependent in the accomplishment of processes or products. Additionally, the PMT gives direction and provides management of the overall design and performance of the program for which it is responsible. [Ref. 8:p.12]

The System Integrating Team (SIT) ensures that the work across various elements of the organization fits together. SIT levels include IPTs that link together the work of two or more interdependent IPTs, as well as teams that cut across various parts of the organization that share a common focus, perhaps on a particular user or product. The SIT's objective is to provide direction and coordinate efforts toward the shared focus of the IPTs. The interdependence

among the IPTs being integrated often stems from the fact that they are participants in a common organizational process in which they play different, but related, roles. [Ref. 8:p. 12]

4. Principles and Characteristics of IPTs

There is no perfect IPT framework that will fit each organization; however, understanding the key principles and characteristics of an IPT, within the PIPT, will help an organization reap the most benefits. IPTs operate under the following six broad principles: [Ref. 10:p. 4]

- Open discussion with no secrets
- Qualified, empowered team members
- Consistent, success-oriented, proactive participation
- Continuous "up-the-line" communication
- Reasoned disagreement
- Issues raised and resolved early

The key characteristics of an IPT are: [Ref. 6:p. 12]

- One leader (or, at most, co-leaders)
- Small working-level teams with no more than 15 people
- Responsibility and limits to authority embodied in characters
- Members with authority to act on behalf of their functional organization (empowered)
- Training in team concepts and rewards for team performance
- Collocation
- Access to media aides such as email, video-teleconferencing
- data/information management software

5. Challenges and Risks of Implementing IPTs

An IPT leader is typically in charge of creating his or her team. Some organization's functional leaders provide names of nominees for the IPT leader to

select from, while, in other cases, an IPT leader would initially propose individuals for the team, and the functional leaders would then agree or negotiate an alternative. The key challenges faced by the IPT leader in creating a team are: [Ref. 1:p. 27]

- Objectives/responsibilities of the team
  - Product cost/schedule/performance requirements
- Authority of the team and team members
- Functional expertise that must be on the team
- Resources of the team
  - Budget, office space, computers, fax, VTC, email
- Personnel arrangements
  - Who does the team report to?
  - Who is responsible for the team members' performance evaluations (IPT leader or member's functional supervisor?)
- What training is necessary?

In addition, there are numerous risks that an IPT leader must consider when setting up a team: [Ref. 1:p. 3]

- IPTs have high "up-front" costs. If offsetting cost and time savings do not materialize, then there are few remedies and little time for recovery
- IPTs can start behaving like committees if individuals put the interests of their functional specialty above the interests of the teams
- IPT structures, with overarching and working-level IPTs, can become over-bureaucratized and top-heavy, hindering progress rather than facilitating it
- Over time, the continued reassignment of functional specialists to integrating teams can dilute the core functional skills, resulting in the loss of corporate knowledge

6. Training and Empowerment Issues

Communication and trust among IPT members is also very important. Therefore, training of team members as a group is most useful because they learn not only what is expected of them as individuals, but also the capabilities of other team members and how each can be expected to contribute. Views on the type and duration of training vary, with some IPT leaders believing a training period of three to five days is appropriate, while others believe that as much as three to four weeks are necessary. The most common issues regarding training are the lack of time for everyone to receive the training and the lack of funding.

Although each organization must tailor its IPT training to meet its specific objectives, the training program should cover the following areas: [Ref. 1:p. 28]

- **Awareness.** The need for cultural change. Why IPTs are being introduced, and how they will benefit the organization and the workforce
- **Orientation.** Exposure to the overall program. Contract information, overall program requirements, and how each IPT contributes to the organization's success
- **Team-building.** How team members should work together, and what is expected of the teams and team members
- **Conflict resolution/negotiation.** How to gain team agreement and acceptance on controversial issues
- **Special skills.** Tailored training to provide or enhance a skill needed by a team member or leader

An additional area of team development concerns empowerment. Empowerment is the authority of an IPT member to act on his or her boss's behalf. Team members should act promptly on matters for which they have experience and authority, but should also understand the limits of their authority. In this regard, experienced IPT leaders say that IPTs can only work if an

organization already has pre-established functional standards on which to base team member empowerment. If no standards exist within an organization, then team members would either have to "wing it" or constantly check back with their supervisors before making any significant decisions. In the later case, many advantages of a teaming arrangement would be lost.

D. SUMMARY

This chapter introduced the development of IPTs and the types of IPTs within DoD. The chapter also provided basic concepts and principles within the Program-level Integrated Product Team (PIPT), key characteristics of IPTs, and the training and empowerment issues associated with IPTs that together, can allow for the successful implementation of the IPT concept.

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III. METHODOLOGY AND DATA PRESENTATION

A. INTRODUCTION

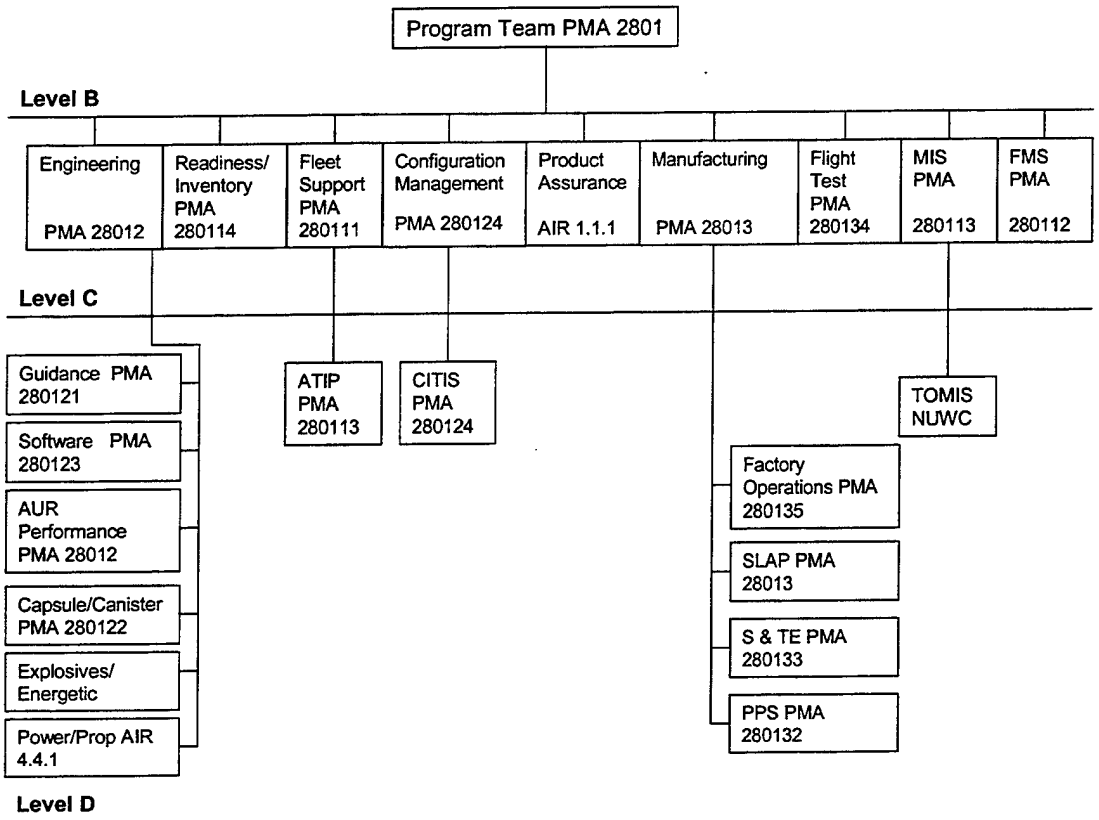
This chapter presents an overview of the Tomahawk Cruise Missile Program-Level IPT (PIPT) structure within DCMA Raytheon followed by an outline of the general research strategy used for this study and presentation of the researcher's findings.

B. OVERVIEW OF THE TOMAHAWK PIPT STRUCTURE

As stated in Chapter II, the number of IPT levels needed in an acquisition program is based upon the risk associated with a product, such as cost, delivery schedule, and product complexity. Early in the program, Raytheon and the Government held several detailed discussions on how to create an IPT structure that would enhance sharing of information between the two parties and result in the Government receiving quality performance missiles at a fair and reasonable price. Unlike the Government, which has several IPT functional areas, Raytheon's in-house IPT structure is made up of the Requirements IPT, Materials IPT, and Factory IPT. Different subspecialty areas, such as engineering, software, and inventory, fall under one of these three in-house IPTs.

Figure 2 presents the PIPT structure within DCMA Raytheon. In Chapter II, Level A (Executive Management Team) is stated as the top level of the PIPT structure. However, Figure 2 does not reflect Level A because it is not part of the IPT structure within the DCMA Raytheon

Figure 2. Tomahawk Program-Level Integrated Product Team.



From: [Defense Contracting Management Agency (DCMA) Raytheon]

Level B is the Program Management Team (PMT), which is co-led by the Raytheon project manager and the Government deputy program manager for Tomahawk. The PMT is responsible for managing a number of IPTs that are interdependent in the production of the product. It manages the overall design and performance of the program and resolves issues arising from the various IPTs.

Levels C and D teams manage the program's resources and risks, integrate Government and contractor efforts, and report program status and issues. Contractor and Government personnel co-lead these IPTs. Selection of

contractor and Government IPT co-leaders and team members is based on factors such as the number of personnel assigned to an IPT and the work experience of those personnel assigned. In some cases, a newly hired person with little or no working knowledge of the IPT concept may be assigned to an IPT. It is also common for contractor team leaders and team members to be assigned to more than one IPT. For example, the contractor program chief engineer is a co-leader for two IPTs and an active team member on several other IPTs. The same can be said for Government personnel.

The frequency of IPT meetings is based on the individual IPT's responsibility. Levels C and D IPTs usually conduct informal meetings on a weekly, bi-weekly, or monthly basis as needed. A quarterly Program Management Review (PMR) meeting is also held at a contractor or Government designated site. The PMR allows the lower level IPTs to provide program updates to the Level B IPT. Programmatic issues not resolved at the lower level IPTs are also addressed at the Level B IPT.

C. GENERAL RESEARCH STRATEGY

The primary research methods used to answer the research questions were a survey and face-to-face interviews. Other forms of communication, such as the telephone, electronic mail, and facsimile, were also used to solicit responses. A comprehensive review of current literature on IPTs was conducted. The literature review focused on: 1) IPT dynamics; 2) IPT performance 3) IPT training; and 4) the working relationship between contractor and Government personnel on IPTs.

The researcher made two separate site visits to the contractor's manufacturing site. The first visit, which lasted two working days, was to observe one of the periodic PMRs. During this visit, the researcher solicited support for this study from the Deputy Program Manager for the Tomahawk Program, DCMA Raytheon, and Raytheon Corporation IPT participants. A second two-day visit was made to conduct face-to-face interviews with the Raytheon Project Manager for the Tomahawk Program and other Raytheon and DCMA Raytheon IPT participants.

1. Interview Participants

Contractor and Government participants who were solicited had one or more years of work experience in the Tomahawk Cruise Missile Program. These participants have worked on IPTs or managed IPTs within the program. The IPT participants held various positions within Raytheon Corporation, DCMA Raytheon, the Naval Air Systems Command (NAVAIR) Cruise Missile Program office, and the Naval Undersea Warfare Center (NUWC).

The researcher also interviewed a cross-section of the population to minimize any bias by soliciting responses from civilian Government employees grades GS-11 to GS-15 and rank O4 military officer. Raytheon employees interviewed ranged from the Quality Assurance Manager to the Configuration Manager to the program's Project Manager.

2. Survey and Face-to-Face Interviews

The researcher created survey questionnaires that were intended to be subjective in nature. Of the 42 contractor and Government personnel who

received the questionnaire, 19 participated, yielding a response rate of 45%. A second method used to gather data was to conduct eight face-to-face interviews.

The face-to-face interviews lasted approximately 30 minutes each. Prior to the interviews, the interviewees were informed of the purpose of the interview and were assured that individuals would not be identified in the thesis. The researcher believed that anonymous interviews would result in a more candid disclosure of information. All of the face-to-face interviews were recorded on a mini tape recorder and then transcribed and compiled into cumulative response lists, which allowed the responses to be categorized and analyzed. Voice recording of the interviews allowed for greater accuracy and expedited the interview process. For each interview, the researcher maintained a separate response form, which included all of the administrative information (name, telephone number, email address, etc.) needed to reestablish contact with the interviewee if necessary.

D. RESEARCH DATA PRESENTATION

The survey and face-to-face interviews conducted were intended to determine each IPT participant's perspective in the four areas of: 1) IPT dynamics; 2) IPT performance; 3) IPT training; and 4) the working relationship between Government and contractor personnel on IPTs.

1. IPT Dynamics

Question 1: Do you find that the IPT decision-making process:

- Provides decisions (better than/the same as/not as well as) your previous process?
- Provides decisions (faster/no faster/slower) than your previous process?

- Provides decisions having (better acceptance/no better acceptance/less acceptance) than your previous process?
- Contributes to the development of your workforce (better than/about the same as/not as well as) your previous process?

Response: Out of 27 respondents, 14 stated that the IPT decision-making process provided better, faster, and better-accepted decisions. The remaining 13 participants saw little or no improvement in the decision-making process. The respondents who saw little or no improvement expressed a feeling that waiting for consensus from other team members on how to address programmatic issues hampers the decision-making process. On the issue of workforce development, the majority of IPT participants surveyed and interviewed felt that the IPT process has improved the overall workforce. As one participant stated:

> IPT gives better exposure to the full spectrum of activities being worked in parallel, thus allowing us to make decisions about our product and its performance. We are no longer working in a vacuum as to how our software will perform with the overall missile environment . . .

Question 2: Do your IPT members:

- Have authority to act on behalf of the functional organization they represent?
- Act solely as "eyes and ears" of their functional organizations, facilitating better-informed and/or faster decision-making by their functional organization?

Response: Out of 27 respondents, 15 stated that they have authority to act on behalf of the functional areas they represent. However, as expected, these participants also stated that their decision-making authority is limited within the scope of their responsibility. They are not allowed to make decisions that

would affect the overall program's cost, delivery schedule, or performance. The remaining 12 participants stated they have no authority to make decisions. These participants felt that they acted solely as the "eyes and ears" for their functional group. The majority of the participants also stated that the authority to make decisions on behalf of the functional group varies among different IPTs.

Question 3: How do you evaluate IPT members? Who evaluates IPT members? Are any incentives/rewards offered?

Response: The majority of contractor IPT participants surveyed and interviewed were not aware of any established incentive or reward program. However, one senior Raytheon official stated that a reward program is in place for recognizing outstanding individual or team contributions to the IPT process. Under Raytheon's program, IPT co-leaders or functional supervisors can submit individuals' names or a particular IPT for consideration of a monetary reward, as determined by Raytheon's management officials. So far this year, several thousand dollars have been awarded for outstanding performance. Government IPT participants are also recognized for their outstanding contributions to the IPTs on which they serve. Government members may receive non-monetary performance awards, such as plaques, Letters of Appreciation, or reserved parking space for their outstanding contributions.

Raytheon IPT members are evaluated annually by their functional area supervisors, who receive evaluation input from the IPT co-leaders. Individual members are ranked within their own functional areas. Government IPT participants are evaluated by their program managers.

Question 4: Do you try to limit IPT size, or do you emphasize instead the need for wide participation?

Responses: All of the IPT co-leaders stated that the size of an IPT is dictated by the scope of the team's responsibility, and not by some predetermined number. They indicated that there is a balance between having the right expertise involved and keeping the IPT a manageable size. Respondents also stated that members are strongly encouraged to seek assistance from other personnel outside of their functional IPT.

2. IPT Performance

Question 1: In your opinion, has IPT improved each of the following areas?

- Reduced the Tomahawk Program cycle time
- Improved efficiency of resource use
- Improved negotiation of design tradeoffs
- Improved suppliers/subcontractors working relationship

Response: Out of 27 respondents, 21 IPT participants stated that the IPT process has, overall, improved each of the four areas. Most IPT co-leaders agreed that the acquisition reform of instilling more insight than oversight in a program has tremendously reduced the program's cycle time. They stated that better coordination between the contractor and the Government has eliminated costly redundant effort, thus improving the efficiency of resource use. IPT co-leaders and team members agreed that the relationships between Raytheon and its suppliers/subcontractors have improved overall. One IPT member stated:

Suppliers and subs have direct inputs into the IPTs, giving them

ownership into the products and processes. This strengthens the relationships and adds cohesiveness to the team.

The remaining six respondents did not think that the IPT process improved any of the areas, but, rather, hindered the overall efficiency of the program. The consensus of these members was that the "working style committee" reduced the chances of making clear decisions in a timely manner. The majority of these same respondents felt that the IPT structure could lead to contractual relationships being ignored. Specifically, they believe that supporting Government agencies might disregard relationships with the prime contractor in favor of directly contacting the subcontractors and suppliers with questions and comments.

Question 2: What challenges do you encounter working in an IPT environment?

Response: Table 2 presents the multiple challenges experienced by IPT participants surveyed and interviewed.

Question 3: Have IPTs established cohesiveness in the program objectives?

Response: The majority of contractor and Government participants in this study agreed that the IPT concept has established cohesiveness in the program. Many respondents felt that the overall program objectives of delivering quality missiles, meeting performance specifications, and achieving target cost have been met, and that there was a clear objective to satisfy the end-user's requirements. The minority of the study participants felt that cohesiveness within

Table 2. Integrated Product Team (IPT) Challenges.

Challenges Encountered	Number of Respondents
Maintaining contractual relationships vs. working together as a fully functional team.	4
Rehashing the same technical data one more time and producing little of value from the repetitive analysis procedure.	18
Collocation – distance of other Government supporting agencies.	6
Schedule/Work Conflict – increased workload makes scheduling difficult.	21
Lack of communication among the IPTs.	10
Lack of focus on schedule performance and program issues.	6
Different objectives/goals among IPT members.	15
Getting contractor to volunteer information.	2
Trust level between contractor and Government personnel.	7
Strong or weak personalities among IPT co-leaders and members.	9

From: [Developed by the researcher]

the program has not reached the level it should. As one participant summed it up:

> Contractor objectives and customer objectives are never identical. Both want a successful program but are motivated differently. Customer members, for example, are not typically motivated by meeting production schedules and contractor cost/profit targets. Customer (Government) team members typically have no sympathy for meeting accelerated delivery schedules to achieve financial incentives. Raytheon is incentivized to meet these schedules.

3. IPT Training

Question 1: Did you have IPT training prior to being assigned to the Tomahawk Program? If so, what was the extent of your training? If not, what reason was given for not offering IPT training (lack of funding, schedule conflict)?

Response: Table 3 presents the number of contractor and Government IPT members with IPT training prior to joining the Tomahawk Program team.

Table 3. Pre Tomahawk Program IPT Experience.

Government		Contractor	
Yes: 5	1. Received formal IPT training while working in previous Government program or agency. Or 2. Received On-the-Job IPT instruction while working on previous Government program.	**Yes: 5**	1. Received formal IPT structure, leadership, and group training. Or 2. Received On-the-Job IPT instruction.
No: 6	1. No formal IPT training was offered. Or 2. Did not know IPT training existed.	**No: 11**	1. Did not know IPT training existed at Raytheon. Or 2. Worked for another company with no established IPT training program.

From: [Developed by the researcher]

Question 2: Do you feel that the IPT training you received prepared you to work in an IPT environment? Why or why not?

Response: The majority of contractor and Government participants felt that despite their limited introduction to the IPT concept, they were prepared to work

in the Tomahawk Program IPT environment. However, some contractor personnel who received either formal or informal IPT training were frustrated that the Government IPT concept is not consistent with the one they learned at Raytheon. Contractor and Government personnel who did not receive IPT training expressed some confusion about the purpose of IPTs, but they have accepted the way that the IPT process is currently run.

Many contractor and Government personnel at the Raytheon Tuscon plant have expressed their desire to participate in a joint IPT training program that would be conducted by Raytheon and the Government. They believe that the information sharing would provide insight into each organization's IPT concept and philosophy.

Question 3: What area of IPT training do you want to see improved (conflict resolution, team-building, leadership, awareness, or group effectiveness)?

Response: Table 4 presents the training areas that the program participants want to see improved. Respondents felt that some of the Level C IPTs are not as efficient as they had hoped them to be. They indicated that team members with different objectives hampered the decision-making process within some of the IPTs. Some contractor team members have observed that their IPT leaders' personalities are not well suited to a particular team function. For example, one team member stated that in particular non-engineering IPT group co-leaders were indecisive on how to address a program issue. Some of the

respondents believe that both the contractor and the Government co-leaders have strong, forceful personalities, which hampered that group's effectiveness.

Table 4. Integrated Product Team (IPT) Training Elements.

Training Area	Number of Respondents
Group Effectiveness	27
Leadership For Team Leaders	22
Awareness	10
Team-building	10
Conflict resolution	7

From: [Developed by the researcher]

Question 4: Do you receive IPT training on a regular basis (provided by either Raytheon or the Government)?

Response: None of the participants surveyed or interviewed indicated that they receive any IPT training on a regular basis. Time, cost, and workload were cited as reasons for not organizing ongoing or refresher type training courses.

4. IPT Working Relationship Between Raytheon and Government

Question 1: How would you describe the relationship and interaction between Raytheon and Government personnel on IPTs?

Response: The majority of contractor and Government IPT participants rated the overall relationships as "good to very good," but added that they could be improved. Contractor and Government officials stated that "you really couldn't tell who is a contractor employee or who is a Government employee" at the

contractor plant, excluding military officers. They indicated that often times the color-coded identification badges used within the manufacturing site are the only way to distinguish between contractor and Government employees.

However, some participants indicated that some IPT groups need improvement in contractor and Government relationships. Team members cited personality clashes, mistrust between the two organizations, and a lack of common alignment of IPT functional group objectives and ground rules as the causes of poor working relationships. Some contractor team members also mentioned the lack of open communication. On more than one occasion, respondents cited incidents in which the Government gave the contractor negative marks for performance failure on the annual Contractor's Performance Assessment Rating (CPAR). However, these respondents indicated that the contractor's weaknesses had never been addressed during informal periodic meetings.

One DCMA person stated that he could sense a lack of cooperation or trust from contractor employees when he walked around the contractor's plant to assess quality assurance performance. He indicated that contractor employees often appeared suspicious when a Government employee was around their workspaces. Another DCMA employee stated that contractor and Government personnel must exercise careful judgment in their personal and professional relationships. Both Raytheon and Government employees live within the same geographic area, attend the same churches, and conduct personal business at

the same local businesses. He believes that failure to separate personal and professional interaction could hamper the IPT working relationships.

Question 2: What biases exist that could affect how Raytheon and Government IPTs function?

Response: Out of 27 respondents, only 11 stated that biases could affect the Raytheon and Government IPTs. However, some respondents indicated that the "contractor vs. Government" mentality still exists between contractor and Government workforces. Some contractor personnel felt that a few Government employees scrutinize their work procedures too much in order to justify their Government jobs. One contractor IPT member explained:

> The traditional Government role has been to evaluate contractor performance vs. participate actively in solving program issues. Conversely, the contractor is still wary of how selected information is presented and shared due to a fear that it will be used later in a negative contractor performance evaluation.

Question 3: If conflict arose, how did the group manage it? How were rough spots overcome?

Response: All 27 respondents stated that any program issues or concerns were first addressed within the individual IPT. If the IPT leaders could not resolve the issues, then the issues were raised to the next level IPT. All of the participants stated that this method of resolving problems at the lowest level possible has worked well.

Question 4: Were there differences in work style that could be attributed to differences in how Raytheon and Government IPT members viewed the work of the team?

Response: Out of 27 respondents, 16 answered yes. Some contractor employees stated that Government IPT members tend to be more directive in assigning tasks for the contractor to complete. According to these employees, Government personnel believe that their role is to ensure that the contract is in place to do a particular action, not to participate in the action themselves. One contractor employee expressed that the differences between the two organizations is even reflected in their cultures:

> When the IPT meets in Tucson, everyone is dressed "Tucson casual." When the meetings are at PAX River, everyone is much more formally dressed – shirt and tie, etc.

One contractor IPT member commented that, in his IPT functional group, the contractor's idea of resolving issues was to find the best possible solution, whereas his Government counterpart's idea of resolving the issue was to find a workable solution as quickly as possible so that the contractor could deliver the missiles. Several Government team members stated that, on various IPTs, the contractor employees disclose to Government team members only what they need to know—nothing more, nothing less.

E. SUMMARY

This chapter presented an overview of the Tomahawk Cruise Missile PIPT structure within DCMA Raytheon, discussed the methodology used for this study,

and presented the researcher's findings. Analysis of the findings will be presented in Chapter IV.

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IV. DATA ANALYSIS

A. INTRODUCTION

This chapter uses the concepts and principles from Chapter II and other literature to analyze the researcher's findings presented in Chapter III. The chapter is divided into four sections covering the following IPT areas: 1) dynamics; 2) performance; 3) training; and 4) working relationships between contractor and Government employees.

B. IPT DYNAMICS

As presented in Chapter III, almost half of the participants surveyed and interviewed felt that the IPT process made little or no improvement in the decision-making process. The main problem that most respondents cited were delays caused by waiting for consensus from their other team members on the best method to resolve programmatic issues.

It is widely recognized that group decision-making can often take longer because the process requires that everyone's opinion must be heard in order to derive the best solution. The DoD publication *Rules of the Road* states that: [Ref. 10:p. 9]

> Each member brings to the team unique expertise that needs to be recognized by all. Because of that expertise, each person's view is important in developing a successful program, and these views need to be heard.

Although the IPT decision process may take more time at the front of the process, it will often save time by avoiding changes downstream that often occur when decisions are made independently.

In addition, in order for the IPT process to be successful, team members' opinions should be considered so that they feel they are a vital part of the team (ownership). Defense Contracting Management Agency's (DCMA) One Book describes the interrelationship of team success and ownership: [Ref. 11]

> A sense of ownership on the part of the IPT members is key to the success of the IPT process. However, a sense of ownership is not possible if the members on the IPT are expected to merely "rubber stamp" others' decision or positions. Ownership is a collective concept. All IPT members must believe that their contributions are important to the process and are fairly and openly considered.

In this area, it is important that all IPT members understand the philosophy of the IPT process and recognize that time well spent in the IPT will often save them much more time down the road.

As Chapter II pointed out, empowerment is one of the principles of IPTs. Chapter III stated that the authority to make decisions for the functional group varies among program-level IPTs. The majority of participants indicated that they are empowered to make decisions for their functional group, while others acted merely as "eyes and ears."

Inconsistency in empowering all of the members of the program-level IPTs could cause the Tomahawk Program to lose many of the advantages of the IPT process. Team members who are not empowered may not know the importance of their work as it relates to the work of others. Additionally, they may not have a

clear understanding of IPT process interdependencies. Qualified and experienced team members should be given the authority to make decisions within the scope of their functional group, which will enhance the overall decision-making process. DCMA's One Book states: [Ref. 11]

> Empowerment is critical to making and keeping the agreements essential to effective IPTs. All representatives assigned to IPTs must be empowered by their leadership. They must be able to speak for their superiors, the "principles," in the decision-making process.

Without empowered members, the tremendous value of the group knowledge that is brought about by the IPT process can be hampered or lost if the decisions are made by supervisors who do not have the benefit of the IPT knowledge sharing process.

In the area of providing incentives and rewards for IPT members, although both the contractor and the Government have established mechanisms for recognizing exceptional performance by IPTs and their members, it appears that these mechanisms are not being used extensively. Emphasized use of these reward systems can be used to reinforce the need for teaming and teamwork, which will continue to improve the IPT results seen through the engagement of the contractor and Government personnel in the IPT decision-making process.

Based on the Tomahawk PIPT structure, the current method used for evaluating team members is consistent with the practices used in other commercial and Government IPT processes. However, the traditional management process of being evaluated by one manager may not be appropriate for a team-based organization like DCMA Raytheon. In a large IPT

environment, such as the Tomahawk Program, an expert-functional team member usually works for two managers, a functional supervisor and one or more IPT leaders. The functional supervisor evaluates and signs the member's appraisal with input provided by the IPT leader(s). This method of dual input recognizes the team member's value from both the functional-expert perspective and the program perspective.

However, difficulty can arise if the team member's appraisal is evaluated and signed only by an IPT leader who is not an expert in the member's technical field. For example, because of legal requirements, contracting personnel must have their appraisals signed by a warranted contracting officer. [Ref. 4:p. 156]

In the area of IPT size, even though the Tomahawk Cruise Missile Program is past its early conceptual development and testing stages, a complex cruise missile program still requires many disciplines and functional experts, and, thus, tends to have larger teams. Senior contractor personnel and Government managers have done well in constructing the various Tomahawk program IPTs with the right number of functional team members to meet the team's objective(s). Team composition on various functional IPTs range from four to 12 personnel. As pointed out in Chapter II, one of the key characteristics of successful IPTs is to have small working-level teams with no more than 15 people.

Although one school of thought suggests that teams should be comprised of "whatever it takes" to accomplish its goal, senior contractor personnel and Government managers must be cautious about adding "ad hoc" members to the

teams. Teams are typically inefficient as decision-making bodies when they become too large.

C. IPT PERFORMANCE

Overall, both the contractor and the Government IPT members acknowledged the positive impact that the IPT process has had on the program's cycle time, resource utilization, design tradeoffs, and subcontractors/suppliers relationships. This response demonstrates that the IPT process does work if the team-based concept is properly implemented by seeking cooperation among all stakeholders. However, in this area the small minority's opinion that the IPT process hindered the overall efficiency of the program raises a concern over these members' understanding of the IPT process.

This recurring feedback points to a potential need for more training in the processes and goals of the IPT process. Prior to IPT implementation, program offices frequently produced a product that was modified substantially or even rejected because of the lack of coordination among the end-user, the program office, and the contractor. The program office invested enormous time and money in correcting the product's deficiencies, which did not always guarantee that the product would be successful. The IPT approach simultaneously takes advantage of all stakeholders' expertise and produces an acceptable product in the most efficient manner.

Few of the contractor team members felt that the IPT process jeopardized prime contractor and subcontractors/suppliers relationships by having the Government going straight to the contractor's subcontractors and suppliers with

questions. There is always potential for the Government to interfere with "privities of contract" in an IPT environment. In a team-based concept, all team members, including the subcontractors and suppliers, are encouraged to participate in an open dialogue. This information sharing is essential to the program's success. Therefore, in the IPT process, the Government must balance the need to collect information from other IPT participants and maintain the arms length relationship that is required due to the "privities of contract" concept.

As Chapter III explained, team members experience multiple IPT challenges. Contractor and Government team leaders need to jointly resolve all the IPT challenges; otherwise, team members may experience a greater sense of frustration and lack of productivity. Even though contractor and Government co-leaders come from two different organizations—the Government being more bureaucratic than its industry partner— effective leaders in any kind of organization must have the ability to: [Ref. 10:p. 5]

- Allocate and manage resources
- Organize work structure
- Apply effective time management
- Focus the group on key issues and maintain the team's objective(s)
- Keep discussions to the main points
- Understand the acquisition process
- Have strong communication skills
- Negotiate win-win outcomes
- Clarify issues and resolve conflicts among team members

The majority of participants are satisfied with the way that the IPT process has made their teams more cohesive in achieving program objectives. Some participants, however, felt that there were inherent differences between the goals of contractor and Government team members. Common objectives are always a concern whenever Government and industry personnel form an IPT in order to produce a product.

From a legal standpoint, the contractor is ultimately responsible for ensuring that the required work is accomplished. This will be the contractor's main focus, and understandably so. The obligation and responsibility of Government team members extends beyond the contract period. The Government team members are not solely concerned about corporate profit, but, rather, what is in the best interest of their customer for the system's life cycle. For this reason, the contractor and the Government do not always have the same objectives.

This sentiment is echoed by NAVAIR INTEGRATED PROGRAM TEAM MANUAL: [Ref. 9:p. 29]

> While teamwork and striving for win-win outcomes between Government and industry is imperative, it is important to maintain the distinction between our Government responsibilities and those of industry. Our IPT members will always accomplish the customary Government work, such as writing Program Initiation Documents (PIDS), conducting source selections, etc.. Where we have entered into a contract with industry, our participation in IPT as a resource, and not as oversight, is equally important as the industry counterpart's responsibility to maintain cost, schedule, and technical performance. While customer/product focus of such IPTs is essential, this should not be allowed to undetermined sound contracting procedures.

Once again in this area a large number of respondents indicated some level of displeasure with "Rehashing the same technical data one more time and producing little of value from the repetitive analysis procedure." The need to address these people's concerns becomes more and more evident with the continuing data analysis.

In the area of "schedule/work conflict" the respondents present a very real problem with any work process that includes repetitive meetings. In today's environment of downsized workforces, finding time in each person's busy schedule to get together for an IPT meeting is a challenging task. However, the fundamental basis of the IPT process relies on the interaction of the various stakeholders in a project in order to achieve successful results. Although there may not be any easy solution or compromise between these issues, the fast moving train called electronic commerce may offer some relief in this area in the future.

D. IPT TRAINING

Of the number of IPT participants surveyed and interviewed, the majority did not have IPT training prior to being assigned to the Tomahawk Program. Reasons vary between Government and contractor personnel: no formal training offered; did not know the IPT training program existed; previous employer did not have an established IPT training program; etc.

The program's senior management seems to have put IPT training on the back burner in order to focus on the more important program issues, such as resolving technical issues and meeting delivery deadlines. The lack of IPT

training between contractor and Government team members contributed to some of the reported problems of members' frustration with the IPT process.

Once hired, all contractor and Government employees received indoctrination to learn about their respective organization cultures. IPT training should be incorporated into the organization's indoctrination so that new team members can see, early on, how the IPT process fits into the Tomahawk program. As DCMA's One Book on IPT process states: [Ref. 11]

> One of the responsibilities of DCMC leadership is to train and educate their staff so they will have the required knowledge and skills to represent their organizations.

The same holds true for contractor senior leadership.

Of the contractor and Government team members who received IPT training, some contractor team members felt dissatisfied that the IPT model they learned was inconsistent with the Government's IPT model. This added to some confusion in understanding the IPT concept, as reported throughout Chapter III. Since contractor and Government personnel are expected to work together, they should be trained together in order to foster the communication and trust team members need in order to ensure IPT success. Joint training not only lets team members know what is expected of them, but also allows them to learn the capabilities and weaknesses of other members and how each can be expected to contribute.

When IPT members were asked what IPT training areas they would like to improve, the overriding responses were group effectiveness and leadership

training for team members. The researcher does not find these responses surprising since most team members have stated their frustration with team leadership and group ineffectiveness throughout the research. This may indicate a common training problem on other contractor and Government projects at the manufacturing site.

All participants surveyed and interviewed stated that they do not receive any IPT refresher training courses. As mentioned earlier in this chapter, senior program management should ensure that all IPT members receive training early on in the program and also continue to provide ongoing or refresher training classes to support the goals of the IPT process.

E. IPT WORKING RELATIONSHIP BETWEEN RAYTHEON AND GOVERNMENT

The majority of team members participating in this study indicated that the working relationships and interaction between Raytheon and Government were good overall. However, a minority of the team members disagreed. A lack of open communication and mistrust were cited as the most common reasons. The communication failure and mistrust between team members attributed to the fact that "contractor vs. Government" mentality is still present within the program. All the literature on the IPT process states that "open discussion with no secret " is an essential part of IPT success. Without openness about program issues, mistrust can lead toward animosity between contractor and Government personnel, which could lead to a bigger problem in the future. Trust is gained only when team members have proven to each other that they are sincere about creating mutual understanding and developing a business partnership.

On the issue of biases that could affect the IPT function, a few team members confirmed the presence of "contractor vs. Government" mentality within the program. Although each entity has its own goals and objectives coming into the program, the key to IPT success is for the co-leaders to focus the group on key issues, to maintain the team's objectives, and to persuade team members to put aside their own goals for the good of the Tomahawk Program. Once again, the research indicates a need for further training on the basic concepts of the IPT process.

On the question of conflict resolution, all the respondents agreed that any program issue or concern was first being handled at the lower level IPTs. This is the correct method of dealing with problems in an IPT environment. Empowering the team members to make decisions allows the senior program managers to tackle more serious programmatic issues, such as program funding, compressed delivery schedule, and performance. This is why both the Raytheon Project Manager and the Government Deputy Program Manager highly encourage their team members to try to resolve minor programmatic issues at Level C and Level D teams before turning to them for a resolution.

On the question of the differences in work style between contractor and Government, the majority of respondents pointed out that the contractor and the Government have cultural differences and different approaches to resolving program issues. Cultural differences will always exist because the contractor is less bureaucratic than the Government. The contractor follows the industry practices of producing products in the shortest time possible without many

regulatory oversights, whereas the Government must follow established acquisition guidelines and regulations. The contractor's bottom line is to make profit from selling missiles, whereas the Government's bottom line is to deliver quality-performance missiles to the fleet.

F. SUMMARY

This chapter presented the researcher's analysis of the findings presented in the previous chapter. Four IPT areas were considered: 1) dynamics; 2) performance; 3) training; and 4) working relationship between contractor and Government. Chapter V will present the researcher's conclusions and recommendations for IPT implementation within DCMA Raytheon.

V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This thesis has examined how the Integrated Product Team (IPT) concept has been utilized in the Tomahawk Cruise Missile Program within DCMA Raytheon. The conclusions in this chapter are supported by the answers to the subsidiary research questions presented in Chapter I, which yield the researcher's conclusion to the thesis' primary research question. This chapter also makes recommendations for further improvement of the IPT process at DCMA Raytheon and provides suggestions for further research topics.

B. CONCLUSIONS

The first subsidiary question asks: "Is the utilization of IPTs achieving the Tomahawk Cruise Missile Program's objective(s)?" Overall, the utilization of IPTs is achieving the Tomahawk Cruise Missile Program's objective(s). All of the team members understand that the program objectives are to provide the best performance cruise missiles and services to the customer (Government) in the most cost-effective and efficient manner possible.

The IPT process has achieved the goal outlined in the Secretary of Defense's 1995 memorandum. The IPT process has added value to the acquisition process by bringing functional disciplines from Government and industry together to simultaneously exchange ideas and build a successful Tomahawk Program. The application of the ten IPPD/IPT tenets, cited in

Chapter II, has been present throughout the Tomahawk Program, despite the minority of IPT participants who would disagree.

The second subsidiary research question asks: "What are the challenges encountered by the Tomahawk Cruise Missile Program's IPTs?" As presented in Table 2 of Chapter III, rehashing the same technical data with no value added, schedule/workload conflict, lack of communication between the IPTs, and IPT members having different objectives and goals are the top challenges presented by the IPT respondents.

The continuous review of the same technical data with little or no value added is a growing concern in an IPT environment. Team co-leaders and members have a tendency to review the same technical data in order to make sure contractor and Government personnel are understanding the same technical information. It is vital that both contractor and Government personnel understand each other's interpretation of technical data in order to avoid costly mistakes in the program. While this process does take time, it is this review by all of the stakeholders that allows the IPT process to derive the best possible solution.

On the issue of schedule/workload conflict, the need to balance workload and attend IPT meetings is a difficult challenge. Productive IPT meetings are vital for information sharing between stakeholders. The use of communication medium such as video teleconferencing (VTC), e-mail, and other forms of e-commerce may provide some relief in the future. In the mean time it is critical

that the IPT members understand and appreciate the importance of the IPT process and the time it takes to generate well-coordinated solutions.

The issue of lack of communication between IPTs needs to be addressed in order to make the IPT process work as efficiently as possible. Communication must not only be vertical within the IPT structure, but it must also be horizontal for successful information sharing between the different IPTs. This horizontal coordination helps to ensure that each individual IPT is working toward the same common goal in a compatible manner. Without this horizontal communication, solutions from one IPT may be in conflict with solutions from other IPTs.

The issue of IPT members having different objectives and goals is always present in a teaming-based arrangement. The contractor's bottom line is to sell missiles and make a profit. The Government's bottom line is to buy quality missiles at a fair and reasonable price. Therefore, contractor and Government personnel do not always have the same objectives and goals in an IPT process. However, these two separate objectives are not mutually exclusive. The IPT process itself can lead to a better understanding by all parties of the goals of each member. By achieving this understanding via the IPT process, solutions can be developed that take into account each member's goals and requirements.

These challenges faced by some of the team members, if not addressed properly, can hamper the program's long-term success with a growing inability to react quickly to uncertainty and technological complexity. In a changing acquisition environment of doing more with less workforce, the need to develop the Tomahawk Cruise Missile in a shorter time and at a minimum Total

Ownership Cost (TOC) puts pressure on the acquisition process and creates greater demand for higher-performing Tomahawk Program IPTs.

Heavy workloads mean that IPTs must find ways of reducing work by improving efficiency; changing roles, responsibilities, and relationships with stakeholders; and finding innovative and efficient ways to accomplish the work. The emphasis on acquisition cost reduction puts pressure on IPTs to find innovative ways to reduce cost, eliminate waste, empower team members, apply new technology, and continuously learn from each other.

All of the literature on the IPT philosophy and principles convey one common message: there is no one perfect IPT model that will work well in all defense acquisition programs. IPT structure in a defense acquisition program requires continuous fine-tuning in order to meet the program's objectives.

The third subsidiary research question asks: "What is the Administrative Contracting Officer's (ACO) role with regard to the IPTs?" Based on questions asked of the ACO during an interview, the ACO's role within the Tomahawk Program IPTs is minimal compared to that of other technical functional experts. The ACO is called upon to be an active IPT member when questions are raised about restructuring a particular section of the contract or if there are major contractual issues that need to be addressed in an IPT environment. Otherwise, the ACO spends the majority of his or her time performing contract administrative duties, such as monitoring contractor compliance with the terms of the contract, addressing performance issues, making changes to the contract via

modifications, and making recommendations to the Procuring Contracting Officer (PCO) on contractual issues.

The fourth and final subsidiary research question asks: "What is the working relationship between contractor and Government personnel on the IPTs?" The working relationship between the two organizations in the IPT environment is good overall. There will always be those who struggle to change their way of thinking because they are comfortable with the old management process they learned in the early years of their respective careers. However, this should not deter them or the younger contractor and Government workforce personnel from accepting the current IPT concept in order to improve program efficiency and better satisfy the customer's requirements. In any defense acquisition program, cooperation and trust between Government and contractor personnel are the two essential elements of a successful business partnership.

Although the Government and the contractor IPT members have some misunderstandings and hold assumptions about each other, both organizations realize that effective Government and contractor interface is crucial to the success of the Tomahawk Program and that both organizations are vital members of the program's IPT structure.

Based upon the above conclusions, the researcher believes that IPTs are being utilized in the Naval Tomahawk Cruise Missile program within the Defense Contract Management Agency Raytheon (DCMA Raytheon) successfully. The predominantly positive responses from the IPT members in all surveyed areas indicates that the implementation of the IPT process has added value to the

Tomahawk program. However, this does not mean that the Government and Raytheon personnel can now rest on their laurels. The issues presented by minority respondents need to be addressed in order to achieve the optimal performance from the IPT structure. The researcher strongly believes that a renewed IPT training program, common across the Government and contractor workforce, will result in significant progress toward a better understanding and appreciation of the IPT process by all personnel involved.

C. RECOMMENDATIONS

Based on the IPT issues identified in this study, the following recommendations are made with the goal of resolving problems and continually improving the IPT processes at DCMA Raytheon. The recommendations are:

1. To continually review empowering qualified and experienced IPT members and expand the advertising of the incentives and rewards systems. As stated in the previous chapter, some IPT members are granted the authority to make decisions for their functional groups, while others simply act as "eyes and ears." The inconsistency in empowering all of the qualified, experienced team members of the program-level IPTs could cause the program to lose many of the advantages of the IPT process. The tremendous value of the group knowledge that is brought about by the IPT process can be hampered or lost if the decisions are made by supervisors who do not have the benefits of the IPT knowledge sharing process.

Empowering all qualified, experienced members to make decisions serves greatly to expedite the decision-making process and allows the IPTs to actually

produce results, rather than simply making recommendations back to individual functional areas for consideration. This issue needs to be addressed with the functional area supervisors who assign the individual IPT members. It is important that these supervisors understand the IPT process and the necessity for the IPT members to be empowered to represent their functional discipline. This issue of IPT member empowerment should be addressed at a future quarterly Program Management Review (PMR). The PMR forum, which is led by the contractor's Project Manager, the Tomahawk Deputy Program Manager, IPT leaders, and functional area supervisors, will ensure that the right people are exposed to this problem area, without the need for scheduling a separate meeting of these valuable Government and contractor personnel.

In the area of providing incentives and rewards to the team members for their contribution to the success of the IPT process, a majority of the IPT participants were not aware of any established incentive or reward program. Currently, any IPT employee awards are only recognized by word-of-mouth and the employees' newsletters.

Although the rewards will not, in and of themselves, ensure successful IPT performance, the mere knowledge of their existence will indicate to the individual IPT members the value that the Government and contractor place on the IPT process. The researcher recommends that the presentation of awards be held in two separate forums. First off, it is important for the employees to be recognized within the setting of their individual IPT. This action will serve to enhance the IPT members' understanding of the importance of what it is they do in the IPT

process. Secondly, the employees should be recognized at a gathering of their fellow functional employees. This action will serve to educate the other employees within the functional discipline on the IPT process and will also indicate to them that their management believes in the importance of working in the IPT environment. These two actions combined will go a long way toward achieving complete buy-in to the IPT process from both the Government and contractor workforces.

2. **To emphasize greater need to train both new and existing contractor and Government personnel on the IPT process.** More than half of the contractor and Government participants have stated that they have little or no IPT training prior to working on the Tomahawk IPT Program. The researcher believes this lack of training has contributed to the frustration felt by those participants within the IPT process, such as the longer decision-making process, lack of open communication between IPTs, mistrust between contractor and Government members, and group effectiveness. For employees that have been working within the Government or industry for several years, the IPT process is a fundamental change in how programs are managed. The researcher believes it is imperative that all employees have a fundamental understanding of the IPT process and its objectives before being assigned to work in an IPT environment.

Without this basic working knowledge of the IPT process, the frustration experienced by some of the IPT members today is almost guaranteed to continue. IPT training should be incorporated as a segment of both contractor and Government indoctrination for newly hired employees, and also for existing

employees who are brought into the Tomahawk Program. It is not safe to assume that new or experienced employees will have an understanding of the IPT process and how it is to work in an IPT environment.

3. **To conduct an evaluation of the possibility of providing IPT training to both Government and contractor personnel in a single setting.** Several team members have expressed their frustrations with contractor and Government goal alignment, IPT leadership, and privities of contract concerns. Currently, each group, the Government and the contractor, conducts their independent IPT training within their respective organization. Along with the general IPT training discussed in the previous recommendation, the researcher believes there is a need for the Tomahawk Program's Government and contractor personnel to receive some level of common IPT training together.

The establishment of this joint training program will force the Government and contractor to ensure that their goals for the IPT process are properly aligned. With this self analysis completed, the joint training will go a long way toward improving on the lack of open communication between IPTs, the mistrust between contractor and Government team members, and the other contractual concerns of the employees. By coming together, both the contractor and Government can have a better understanding of each other's work attitude and objectives of the IPT process.

D. SUGGESTIONS FOR FURTHER RESEARCH

Two areas for further research relating to IPT process are identified:

- Based on the lack of IPT training that was found in this research, and the Government's commitment to the IPT process, an analysis should be made to consider whether the IPPD and IPT processes should become mandatory training elements within the Defense Acquisition Workforce Improvement Act (DAWIA) certification program?

- Based on the different perceptions of the IPT process found from the Tomahawk Program's Government and contractor personnel, an analysis should be conducted to determine if the DoD should sponsor IPPD and IPT process training for the defense industrial base contractors?

APPENDIX. TEN TENETS OF INTEGRATED PRODUCT AND PROCESS DEVELOPMENT (IPPD)

1. Customer Focus. The primary objective of IPPD is to satisfy customer's needs better, faster and at less cost. The customer's needs should determine the nature of the product and its associated processes.

2. Concurrent development of products and process. Processes should be developed concurrently with the products, which they support. It is critical that the processes used to manage, develop, manufacture, verify, test, deploy, operate, support, train people, and eventually dispose of the product be considered during development. Product and process design and performance should be kept in balance.

3. Early and continuous life cycle planning. Planning for a product and process should begin early in the science and technology phase (especially advanced development) and extend throughout the product's life cycle. Early life- cycle planning, which includes customers, functions and suppliers, lays a solid foundation for the various phases of a product and its process. Key program events should be defined so that resources can be applied and the impact of resource constraints better understood and managed.

4. Maximize flexibility for optimization and use of contractor-unique approaches. Request for Proposal (RFP) and contract should provide maximum flexibility for optimization and use of contractor unique process and commercial specifications, standards and practices.

5. Encourage innovative design and improved process capability. Encourage use of innovative design and manufacturing techniques that promote achieving quality through design, products with little sensitivity to variations in the manufacturing process, and focus on process capability and continuous process improvement. Utilize such tools as "six-sigma" process control and lean/agile manufacturing concepts to advantage.

6. Event-driven scheduling. A scheduling framework should be established which relates program events to their associated accomplishments and accomplishments criteria. An event is considered complete only when the accomplishments associated with the event have been completed as measured by the accomplishment criteria. This event-driven scheduling reduces risk by ensuring that product and process maturity are incrementally demonstrated prior to beginning follow-on activities.

7. Multidisciplinary teamwork through IPTs. Multidisciplinary teamwork is essential to the integrated and concurrent development of a product and its process. The right people at the right place at the right time are required to make timely decisions. Team decisions should be based on the combined input of the entire team (e.g., engineering, manufacturing, test, logistics, financial management, contracting personnel) to include customers and suppliers. Each team member needs to understand his or her role and the role of other members, as well as understand the constraints under which other team members operate. Communication within teams and between teams should be open, with success emphasized and rewarded.

8. Empowerment. Decisions should be driven to the lowest level commensurate with risk. Resources should be allocated at levels consistent with authority, responsibility, and the ability of the people. The team should be given authority, responsibility, and resources to manage its product and its risk commensurate with the team's capabilities. The team should accept responsibility and be held accountable for the results of its effort.

9. Seamless management tools. A framework should be established which relates products and process at all levels to demonstrate dependency and interrelationships. A single management system should be established that relates requirements, planning, resource allocation, execution, and program tracking over the product's life cycle. This integrated approach helps ensure that teams have all available information, thereby enhancing team decision-making at all levels. Capabilities should be provided to share technical and business information throughout the product life cycle through the use of acquisition and support databases and software tools for accessing, exchanging, and viewing information.

10. Proactive identification and management of risk. Critical cost, schedule and technical parameters related to system characteristics should be identified from risk analyses and user requirements. Technical and business performance measurement plans, with appropriate metrics, should be developed and compared to best-in-class industry benchmarks to provide continuing verification of the degree of anticipated and actual achievement of technical and business parameters. [Ref. 7]

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   ATTN: MAJ McDermott
   P.O Box 11337, Bldg. 801 M/S D4
   Tucson, Arizona 85734-1337

7. LCDR David H. Kao, SC, USN 2
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   PSC 451 Box 531
   FPO AE 09834-2800